DEPARTMENT OF PHYSICS

PROGRAMME SPECIFIC OUTCOME

After successfully completing B.Sc. in Physics Honours and Program courses, the students are expected to demonstrate the following qualities.

1. **Contents:** Knowledge and conceptual understanding of subjects in Physics such as Classical Mechanics, Electricity and Magnetism, Electromagnetic Theory, Wave and Optics, Thermal Physics, Electronics and Digital Systems, Analog Systems, Modern Physics, Solid State Physics, Quantum Mechanics, Statistical Mechanics, etc.
2. **Mathematical Skills:** Proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics and apply those to solve problems in Physics. They are also expected to demonstrate the ability to translate a physical description to a mathematical equation. In fact, Physicists are renowned for their problem-solving capabilities.
3. **Application of Acquired Knowledge:** Ability to apply the knowledge gathered in Physics to practical problems and make life simpler in day to day activities, understand how nature works and even machines we depend on in our daily life.
4. **Laboratory skills:** Ability to perform laboratory experiments by own, run instruments, record data, analyze them and draw valid conclusions from them. Ability to use various laboratory based analysis tools, graphs, techniques, software and computers.
5. **Computational skills:** Aptitude in computational techniques, programming and utilizing them to solve theoretical physics problems.
6. **Background for future research works:** Laboratory based instrumentation skills and theoretical understanding of Physical concepts in coherence with computational techniques is all what is needed for a background and foundation for future research works in Physics.

COURSE OUTCOME

Mechanics

1. Understand dynamics of particles and rigid bodies both linear and rotational motions.
2. Ability to write the equations of motion in different dynamical situations and solve them. Make predictions of the state of the moving entity at future times.
3. Clear idea of basic mechanical principles, energy principles, collision dynamics, oscillatory motion, pseudo forces, terrestrial forces, etc.
4. Concepts of properties of matter such as elasticity, surface tension, viscosity and mechanics of fluids and to solve numerical problems.
5. Understanding of the effects of velocity of an object being close to that of light in the context of special theory of relativity and ability to solve problems.

Electricity and Magnetism

1. Concepts of the laws of electric charge, current electricity and the interrelationship with magnetism in vacuum as well as in a material medium.
2. Idea of the origin of magnetic field in the presence of electric current in different situations and the converse phenomenon of electromagnetic induction.
3. Understanding of the behavior of magnetic materials.
4. Clear idea of the behavior of alternating current in different circuit combinations and ability to use different network theorems in practical situations.
5. Ability to write electrical equations and solve numerical problems.

Thermal Physics

1. Understanding of the idea how thermal properties of matter can be described both using molecular dynamics as in kinetic theory and statistical ideas as in thermodynamics.
2. Clear idea of dynamical equations in kinetic theory as well as laws of thermodynamics and how one can explain different thermal properties of gas using them.
3. Conversant with mathematical tools and partial differential equations and how one can use them to solve different problems in thermal physics.

Modern Physics

1. Understand how major concepts in modern physics, such as quantum description of particles, developed and changed over time.
2. Clear understanding of the foundations of quantum mechanics.
3. Concepts of the very different physics in the nucleus of an atom and how quantum mechanics can be applied in some cases for describing observations of related nuclear properties.
4. Ability to use differential equations to solve elementary quantum mechanical problems.

Quantum Mechanics

1. Concepts of how mathematical tools such as differential equations can be applied in an abstract sense to ultimately explain real physical observations of particle behavior which cannot be explained by classical mechanics.
2. Clear idea of the techniques used in quantum mechanics to solve practical problems
3. Understanding of how quantum mechanics can describe atomic spectrum and behavior of atoms in electromagnetic fields.

Solid State Physics

1. Clear idea of differences between crystal and amorphous and the physics within.
2. Concepts of symmetry and periodicity in crystals and how the introduction of periodicity in a standard quantum mechanical scenario brings out the properties of crystalline solids.
3. Understand how the theory of solids developed gradually over time to and the ability to correlate theory with experimental results.

4. Concepts of band structure in solids and how it can resolve unsolved differences between older theory and experiments.

Mathematical Methods of Physics

1. Students can understand and identify different mathematical function and its properties and apply them appropriately in solving various problems in physics.
2. They can use Fourier transform to obtain the Fourier series of periodic functions in physics and apply transform methods to solve elementary differential equations of interest in physics and engineering.
3. The students can learn programming and applying it to physics problems.
4. Students will get the basic idea of scientific computing.

Wave and Optics

1. Students will develop the concept of wave motion.
2. The student will get an introduction to the discipline of optics and its role in the modern society.
3. The student will be introduced to various designs of optical systems and aberrations with an emphasis on image forming systems. Finally, the student will get a thorough introduction to image forming systems with emphasis on the human eye, the camera, the telescope and the microscope.
4. The wave optics part of the course will give the student a thorough fundamental knowledge about the different phenomenon of physical optics.

Digital Systems and Applications

1. Students will continue use of concepts covered in Digital Fundamentals.
2. Student will be able to demonstrate understanding of the different families of digital integrated circuits and their characteristics.
3. They will be able to analyze, design, build and troubleshoot a broad range of combinational circuits using digital ICs.
4. They will demonstrate understanding of the basics of programmable logic devices and implement circuits on them.
5. They will be able to analyze, design, build and test hardware and software applications.

Analog Systems and Applications

1. Learning various fundamental concepts of analog systems may help the students to apply the concepts in building an analog system prototype.
2. By the end of this course, students should be able to understand the fundamental concepts of analog systems and apply the same in real world applications.

Electromagnetic theory

1. The student shall be able to formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media and also solve such problems in simple geometries using separation of variables and the method of images.
2. They can define and derive expressions for energy both for the electrostatic and magnetostatic fields and derive Poyntings theorem from Maxwell's equations and interpret the terms in the theorem physically.

Statistical Mechanics

1. Students learn how to evaluate macroscopic thermal properties of matter (specific heat, magnetic susceptibility, etc) from microscopic dynamics.
2. The course begins with first using classical dynamics and then using quantum dynamics as the microscopic principles.
3. Students would get a good grasp of modern statistical mechanics of interacting, classical and quantum systems and learn the techniques mentioned in the syllabus. A good knowledge of this subject is essential to understand recent developments in large parts of condensed-matter science.

Nuclear and Particle Physics

1. Concepts of the very different kind of forces and the physics thereof that prevail in the nucleus of an atom.
2. Understanding of how quantum mechanics can be applied in some cases for describing observations of related nuclear properties.
3. Clear idea of the models that describe a nucleus, different nuclear phenomena, nuclear reactions and radioactivity, etc. Conception of various high energy particles, their properties and reactions, etc.
4. Clear technical knowledge of various detecting and counting instruments used in nuclear and particle physics.

Computational Physics

1. General idea of the structure and working of a computer.
2. Idea of the importance and use of computers in Physics to aid numerical simulations, modeling, tedious calculations in various practical problems.
3. Concepts of problem solving through algorithms and flowchart using logic. Knowledge of important programming languages.
4. Knowledge of other application packages used for scientific data handling and analysis, word processing and data representation in the form of graphs.
5. Extensive experience in programming to solve numerical problems in Physics using computer programs.

Devices and communications

1. Understand and use correctly terms introduced in this course in relation to communication networks.
2. Understand general principles involved in data exchange between devices.
3. To prepare mathematical background for communication signal analysis.
4. To understand the building blocks of digital communication system.

Renewable Energy and Energy Harvesting

1. The students can understand the basics of how each renewable energy technology works. And how it can be utilized for electric energy production.
2. They can distinguish between the main types of renewable energy technology and what each can perform and the process of achieving that.
3. They can identify which might be the most appropriate technology for any given scenario.
4. Generating electricity from sustainable energy sources and keeping track of key public policies affecting renewable power generation and identify the role played by these policies in shaping the electric power industry and make a payback calculation for each technology.
5. The "Energy harvesting" deals with overview of independent ways of generating energy from surroundings for autonomous supplying of wireless sensors, remote electronics and low power devices. Students will be able to analyze ambient energy for energy harvesting from the concrete industrial system.
6. They can select the best way of supplying modern autonomous electronics.